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MONTANA STATEWIDE STREAM SURVEYS: 1994 MACROINVERTEBRATE ASSESSMENTS

prepared for
Montana Department of Health and Environmental Sciences
Water Quality Division

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INTRODUCTION

The Montana Department of Health and Environmental Sciences - Water Quality Division's (WQD) Nonpoint Source Program utilizes aquatic macroinvertebrates to assess the biological condition of streams. Rapid Bioassessment Protocols (RBP) macroinvertebrate surveys are used to rank streams by degree of impairment and potential for improvement. These data are also used to document the effectiveness of "best management practices" and to evaluate the success of pollution control projects conducted under Section 319 of the Nonpoint Source Pollution Control Program.

This report presents macroinvertebrate-based RBP assessments of biological condition in 26 streams during 1994 (Table 1). Streams were located throughout much of the state (Map).

METHODS

Field

Habitat was characterized and macroinvertebrate samples were collected from each stream by personnel from OEA Research under contract to the WQD. Habitat evaluations included the standard WQD Physical Characterization and Water Quality Field Data as well as modified versions of the U.S. EPA Rapid Bioassessment Protocols (RBP) habitat forms. Depending on stream morphology, RBP numerical classifications were for either predominantly riffle/run or pool/glide habitats.

A single traveling kick sample was collected from each stream reach. Qualitative samples of macroinvertebrates inhabiting riffles were obtained by disturbing (kicking) the substrate while traversing the stream channel. Riffle habitats were sampled whenever possible. A standard D-net with 1 mm mesh was used to capture dislodged organisms. Site selection criteria and sampling techniques are described in more detail by Bukantis (1994).

Laboratory

Laboratory and data analysis were contracted to McGuire Consulting. A 300 organism subsample was obtained from each sample using RBP III sorting methodology (Plafkin et al. 1989 - Appendix B.2). Samples were rinsed to remove the preservative and evenly distributed in a girded enamel pan. All organisms within a randomly selected grid were removed. This process was repeated until approximately 300 organisms were recovered. If the sample contained fewer than 300 organisms the entire sample was processed.

Macroinvertebrates were identified to the lowest practical taxonomic level, usually genus or species. Taxonomic resolution used in metric calculations were those recommended by Bukantis (1994).

Data Analysis

Macroinvertebrate data were analyzed to provide numerical estimates of biological integrity. The philosophy and mechanics of multiple-metric bioassessments are described in Plafkin et al. (1989). This approach is still being refined (Barbour et al. 1992) and analysis protocols for Montana streams continue to evolve (Bukantis 1994).

For RBP analyses, Montana streams have been grouped into three primary physiographic regions: mountains, foothills and valleys, and plains (Bahls et al. 1992). A separate set of metrics and scoring criteria was used for each of these ecoregions. The selection of metrics, reference values and scoring criteria were based on previous RBP studies in Montana (Wisseman 1992, McGuire 1992a & b, 1994a & b). Metrics used in this analysis are described in Plafkin et al. (1989), Hilsenhoff (1987), Shakleford (1988) or the Montana studies cited above. Functional feeding group assignments and biotic tolerance values were those compiled by Bukantis (1994).

Each metric was assigned a score (0 to 6) based on its percent similarity to the reference value (Table 2). Scores for all metrics were totaled and biological integrity was expressed as a percentage of the maximum possible score. Criteria for classifying biological impairment (Table 3) are from Plafkin et al. (1989).

A variety of other metrics were also calculated, including several similarity indices and an experimental metals tolerance index (Appendix A). The basis for the metals tolerance index and most tolerance values were taken from investigations in the Clark Fork River Basin (McGuire 1993). While not incorporated into the RBP assessment, these metrics were used to further describe the community and provide insight to the types of impacts present.

The RBP habitat assessments incorporated numerical scores for twelve parameters. Habitat parameters and scoring criteria for streams with a prevalence of riffles/runs (Table 4) were different than for streams with predominately pool/glide habitats (Table 5). Scores for each parameter were summed to determine cumulative habitat condition. Cumulative scores were expressed as a percentage of the maximum possible score and habitat was categorized as optimal, sub-optimal, fair or poor.

RESULTS and DISCUSSION

Plains streams

Eleven streams in the plains ecoregion (Table 1) were evaluated. Bioassessment scores ranged from 11 to 94% (Table 6) with three streams classified (Table 3) as nonimpaired, two as slightly impaired, five as moderately impaired and one severely impaired stream. Habitat was assessed as sub-optimal to fair in all plains streams with scores ranging from 43 to 58% (Tables 4 and 5).

Careless Creek

Careless Creek, located in the Northwestern Great Plains ecoregion, appeared fairly healthy. The bioassessment score of 83% was classified as nonimpaired. The stream supported a fairly diverse benthic assemblage that included modest populations of mayflies, stoneflies and caddisflies. The RBP habitat assessment was 56% of the maximum possible score (Table 5) and was considered sub-optimal to marginal. Low stream flow (<10 gpm) was the primary factor lowing the overall habitat score. Scores for metrics evaluating velocity/depth combinations and channel flow status received considerably lower scores than other habitat parameters. Riffle habitat was common in the reach investigated.

Yellow Water Creek

Biological integrity (53%) was slightly to moderately impaired in Yellow Water Creek. The benthic fauna was dominated by *Caenis* mayflies; however, few other EPT taxa were present. Overall habitat condition (58%) was rated as sub-optimal (Table 4). All 12 habitat parameters were rated from sub-optimal to marginal and no single factor was identified as a primary cause of habitat degradation. The predominately sand/silt substrate and high salinity may be natural limiting factors in this stream.

Flatwillow Creek

Flatwillow Creek had sub-optimal habitat (55%) and biointegrity (50%) appeared to moderately impaired. The 60 second traveling kick sample contained only 124 macroinvertebrates, so the biological assessment may be somewhat tenuous. The mayfly, *Choroterpes*, dominated the sample and few other macroinvertebrates were collected. All habitat parameters were rated as sub-optimal to marginal. The stream substrate, gravels embedded in sand, silt and clay, received the lowest habitat scores. High salinity may also limit biointegrity in this stream.

Big Coulee

Biological integrity was nonimpaired (89%) in the Big Coulee. Despite high salinity and sub-optimal to marginal habitat, this stream supported a diverse macroinvertebrate fauna that included 10 mayfly and caddisfly species. Using the riffle/run habitat assessment form, the overall habitat score was 53% (Table 5). Unstable banks, poorly protected by vegetation in a narrow riparian zone, were identified as the a primary causes of habitat degradation.

Coffee Creek

Biological integrity was severely impaired (11%) in Coffee Creek. The amphipod, *Hyalella azteca* comprised more than 90% of the macroinvertebrates collected at this site. Minimal stream discharge (0.5 cfs) and high salinity appeared to be factors limiting the benthos. Overall habitat condition (43%) was classified as marginal. Unstable banks that were poorly protected by vegetation, a narrow riparian zone, and predominately silt substrate were prominent features of the degraded habitat.

Arrow Creek

Arrow Creek was nonimpaired and had the highest biointegrity (94%) among the plains streams investigated. The macroinvertebrate fauna was dominated by caddisflies and mayflies. Sub-optimal habitat (55%) was indicated by the glide/pool habitat assessment. All habitat parameters received similar scores in the sub-optimal to marginal categories.

Wolf Creek

Biological integrity (64%) was slightly impaired in Wolf Creek. Although *Caenis* mayflies were abundant, only two other EPT taxa were collected. Habitat was rated as marginal (46%). The predominately sand substrate and minimal discharge (1 gpm) appeared to be limiting factors.

Dry Wolf Creek

Dry Wolf Creeks biointegrity was moderately (33%) impaired. The fauna was dominated by the amphipod, *Hyalella azteca*. Mayflies and caddisflies were present but were poorly represented. Habitat was rated as marginal (46%). The predominately sand/silt substrate and minimal discharge (1 gpm) appeared to limit habitat quality and biological integrity.

Dog Creek

Stream discharge was less than 1 gpm and little flow was evident in Dog Creek when sampled in September, 1994. The macroinvertebrate sample contained only 47 organisms. Based on this small sample, biological integrity appeared to be moderately impaired in Dog Creek. Tubificid oligochaetes were the most numerous organisms in the sample, a condition that usually indicates organic pollution. Habitat was rated as sub-optimal (58%). Habitat parameters receiving relatively low scores included flow status, bank vegetative cover and substrate composition.

Nelson Creek

When sampled in July, 1994, no surface flow was evident in Nelson Creek. Overall habitat was rated marginal (43%). Instream habitat was poor and consisted of shallow pools with silt/clay substrates. The 60 second macroinvertebrate sample contained only 11 organisms. The low number of macroinvertebrates collected was probably a better indicator of impaired biointegrity than the RBP assessment.

Timber Creek

Biological integrity appeared moderately impaired in Timber Creek. Only 13 macroinvertebrate taxa were present in the sample. *Caenis* mayflies accounted for 65% of the organisms collected. Overall habitat condition (55%) was rated as sub-optimal with low stream flow, lack of instream cover and limited bank vegetation identified as limiting factors.

Foothill and Valley streams

Bioassessment scores for 10 foothill and valley streams ranged from 29 to 88% (Table 7). One stream was classified as nonimpaired, five streams were slightly impaired and four streams were moderately impaired. Habitat scores ranged from 24 to 79% but were generally classified as sub-optimal or marginal (Tables 4 and 5).

Jerry Creek

The macroinvertebrate sample from Jerry Creek was highly unusual; flatworms accounted for nearly 50% of the organisms collected and the taxa present were more typical of a mountain stream than a foothills stream. The skewed relative abundances of functional feeding groups, and low numbers of EPT taxa and EPT individuals indicated impairment at this site. Biointegrity (46%) was classified as moderately impaired.

Overall habitat condition (64%) was considered sub-optimal. Most primary (instream) and secondary (channel morphology) parameters were rated as optimal while tertiary (bank) parameters and flow status were classified as marginal.

Pintlar Creek

Biointegrity was moderately impaired (48%) in Pintlar Creek. Organic enrichment, attributable to beavers, appeared to the primary cause of reduced biointegrity. Impacts were indicated by the high biotic index and low values for EPT richness, EPT abundance and % Scrapers + Shredders metrics.

Habitat was evaluated using the glide/pool assessment because of extensive impoundment by beaver dams. Pintlar Creek received the highest habitat score among the 11 streams evaluated using this form (Table 5). Overall habitat condition (73%) was rated as sub-optimal. Stream bank and riparian habitat components were considered optimal. The predominately sand substrate was the primary factor reducing habitat condition.

Ruby River

Biological integrity (58%) was slightly impaired in the lower Ruby River. Impacts in this reach were attributable to nutrient enrichment and sediment deposition and appeared to be a classic examples of nonpoint source pollution. Most biological metrics indicated some degree of impairment. Overall habitat condition (69%) was classified as sub-optimal. The primary factors reducing habitat condition; sediment deposition, substrate embeddedness and bank condition, were rated marginal.

Big Pipestone Creek

Big Pipestone Creek, below the Whitehall sewage lagoons, had the lowest biointegrity among the 10 valley and foothill streams evaluated. Biointegrity (29%) was moderately impaired and organic pollution was evident. *Daphnia* were the most abundant organism in the kicknet sample but were considered transients from the sewage lagoons and were excluded from the analysis (See Appendix B for comparison with and without *Daphnia*). Four of eight biological metrics (EPT richness, Hydropsychinae/Trichoptera, % Collectors and % Scrapers + Shredders) received scores of 0. Both organic pollution and habitat degradation diminished biological integrity in Big Pipestone Creek. Habitat was classified as marginal (39%). Tertiary (bank and riparian) parameters were rated sub-optimal while most instream parameters were considered marginal. The highly embedded sand substrate was classified as poor.

Mussigbrod Creek

Biointegrity (58%) was slightly impaired in Mussigbrod Creek. Chironomidae dominated the fauna and six metrics indicated slightly reduced biointegrity. However, Mussigbrod Creek had the highest habitat score (79%) among the valley and foothill streams evaluated. All habitat parameters were rated as optimal or sub-optimal. Water quality may limit biointegrity in this stream reach. The relatively high metals tolerence index (4.8) idicated that metals pollution may contribute to biological impairment.

Birch Creek

Although the reach investigated was located in the valley and foothill ecoregion, Birch Creek retained many physical characteristics of the mountain ecoregion. In addition, the macroinvertebrate fauna was more typical of a mountain stream than a foothills stream. Therefore bioassessments were made using both sets of criteria. Using the valley and foothill ecoregion criteria, this site was nonimpaired and had the highest biointegrity (88%) among the 26 streams surveyed. When compared to the mountain ecoregion criteria, biointegrity was slightly impaired (67%). This was due to the predominance of dipterans (40%) in the sample and the more stringent criteria for EPT richness, % EPT and % scraper + shedder metrics in the mountain ecoregion.

While the macroinvertebrate sample from Birch Creek was collected upstream from an irrigation diversion, the habitat assessment included areas above and below the diversion. Overall habitat quality was rated as sub-optimal (70%) with reduced habitat condition below the diversion. Below the diversion, channel alteration, limited depth/velocity combinations and reduced bank condition were noted.

Duck Creek

Duck Creek had the lowest habitat rating among the 10 valley and foothill streams evaluated. No habitat parameter was rated higher than marginal and overall habitat condition (24%) was marginal to poor. Bank and riparian conditions were extremely poor as were silt embedded stream substrates. Biointegrity was moderately impaired (33%) in Duck Creek. The macroinvertebrate fauna was composed of taxa tolerant of sediment and organic pollution and reduced biointegrity was indicated by seven of eight metrics. The biotic index, EPT richness, % scrapers + shredders, and % EPT metrics received scores of 0.

Elk Creek

Biological integrity in Elk Creek (54%) appeared to be slightly impaired. The predominance of filter-feeding macroinvertebrates indicated organic enrichment and resulted in low scores for functional feeding group metrics. The low EPT richness and % abundance of the dominant taxon also indicated some impairment. Habitat was rated sub-optimal (73%). The primary (instream) parameters were classified as optimal. Most other habitat parameters were considered sub-optimal. The low stream flow at the time of sampling reduced the overall habitat score.

Cottonwood Creek

Both habitat condition (61%) and biointegrity (54%) were slightly impaired in Cottonwood Creek. Riffle development and benthic substrate were considered optimal which may account for the diverse benthic fauna. Most other habitat parameters were sub-optimal although flow status, riparian vegetation and riparian width were considered marginal. Scraper and shredder functional feeding groups were poorly represented while pollution tolerant taxa, such as *Cheumatopsyche* and Chironomidae were abundant.

Beaver Creek

Biointegrity in Beaver Creek, a tributary to Cottonwood Creek, was also slightly impaired (63%). Slightly reduced biointegrity was indicated by low EPT richness and a relatively high biotic index. Habitat was characterized as sub-optimal (61%). Habitat parameters receiving relatively low scores included sediment deposition, frequency of rifles, substrate embeddedness and riparian width.

Mountain streams

Assigning streams to the mountain ecoregion was problematic since sampling locations appeared to be transitional between the mountain and valley-foothill ecoregions. Therefore, streams were evaluated using both ecoregion criteria. Based on the mountain ecoregion criteria, biological integrity ranged from 38 to 67% (Table 8). Two streams were classified as slightly impaired while four streams were moderately impaired. Habitat scores ranged from 39 to 89% with classifications ranging from marginal to optimal (Table 5).

Crow Creek

The bioassessment score (50%) for Crow Creek fell between the slightly and moderately impaired categories. Biointegrity was slightly impaired (67%) using valley and foothill criteria. The fauna was characterized by relatively low taxa and EPT richness and a high relative abundance of blackflies. Five of seven metrics indicated biological impairment. Overall habitat condition (57%) and most habitat parameters were sub-optimal. Riparian vegetation was in poor condition.

Beaver Creek

The sample from near the mouth of Beaver Creek indicated moderate biological impairment (38%) when compared to the mountain stream RBP criteria and slight impairment (54%) using the valley and foothill criteria. The fauna was more typical of a valley/foothill stream than a mountain stream. Community composition may have been influenced by the proximity of the sampling site to the Missouri River. The functional feeding group metrics and the relatively high biotic index suggested that organic/nutrient enrichment may reduce biological integrity in Beaver Creek. Habitat was in optimal to sub-optimal condition (82%) with no parameters indicating significant habitat degradation.

Dry Fork Belt Creek

Habitat was considered optimal in Dry Fork Belt Creek and the habitat score (89%) was the highest of 27 assessments included in this report. Unfortinately, the 60 second kicknet sample contained only 49 macroinvertebrates which precludes a reliable biological assessment.

Basin Creek

Basin Creek, sampled at its confluence with the Boulder River, was in transition from a mountain stream to a valley stream. Compared with mountain ecoregion criteria, the stream was slightly to moderately impaired (52%). Using less stringent valley and foothill ecoregion criteria, Basin Creek was slightly impaired (77%). Most metrics indicated some degree of impairment. Degraded habitat was the most prominant cause of biological impairment. Overall habitat condition was classified as marginal (39%). Channel alteration, poor riffle development, limited habitat diversity and poor riparian condition were identified as problems in Basin Creek.

Wise River

The biological integrity of the Wise River was classified as moderately impaired (43%) using the mountain ecoregion RBP criteria and slightly impaired (67%) using valley-foothill criteria. Scores were lowest for the EPT richness and % EPT metrics in both assessments. The relatively high metals tolerence index (4.8) suggested that metals pollution may contribute to biological impairment at this site. Habitat was classified as sub-optimal (76%) due, primarily to low stream flow and channel alteration.


LINCOLN
FLATHEAD
KALISPELL
Flathead Lake
SANDERS
LAKE
MINERAL
MISSOULA
MISSOULA
GLACIER
TOOLE
LIBERTY
HILL
HAVRE
BLAINE
PHILLIPS
VALLEY
DANIES
SHERIDAN
ROOSEVELT
GLASGOW
PONDERA
TETON
CHOUTEAU
Fort Peck Lake
RICHLAND
McCONE
GARFIELD
DAWSON
GLENDIVE
WIBAUX
PRAIRIE
GREAT FALLS
CASCADE
FERGUS
PETROLEUM
JUDITH BASIN
LEWISTOWN
LEWIS AND CLARK
MEAGHER
WHEATLAND
GOLDEN VALLEY
MUSSELSHELL
ROSEBUD
MILES CITY
CUSTER
FALLON
HELENA
GRANITE
BROADWATER
JEFFERSON
RAVALLI
DEER LODGE
SILVER BOW
BUTTE
TREASURE
YELLOWSTONE
BILLINGS
GALLATIN
BOZEMAN
PARK
SWEETGRASS
STILLWATER
CARBON
BIG HORN
CARTER
POWDER RIVER
MADISON
BEAVERHEAD
Missouri
Marias River
Milk River
Yellowstone River
Clark Fork
Flathead River
Blackfoot River
Bitterroot River
Jefferson River
Madison River
Gallatin River
Big Horn River
Tongue River
Powder River
Natural Resource
NRIS Information System
Montana State Library

Table 1. 1994 Montana stream surveys - RBP macroinvertebrate sampling locations.

Ecoregion	County	Sampling location	map#
Northern Rockies (#15)			
Crow Creek	Broadwater	T5N R1E sec 22	16
Wise River	Beaverhead	above bridge in Wise River	18
Basin Creek	Jefferson	near mouth	23
Middle Rockies (#17)			
Dry Fork Belt Creek	Cascade	above bridge near Monarch	12
Beaver Creek	Lewis & Clark	near mouth	15
Northern Montana Glaciated Plains (#41)			
Big Coulee	Cascade/Teton	T20N R2W sec 5	5
Northwestern Glaciated Plains (#42)			
Timber Creek	McCone		28
Nelson Creek	McCone	0.5 mi upstream from Ft. Peck Reservoir	29
Northwestern Great Plains (#43)			
Careless Creek	Golden Valley	T9N R18E sec7	1
Yellow Water Creek	Petroleum	upstream from Hiway 244	2
Flatwillow Creek	Petroleum	Melstone road	3
Coffee Creek	Fergus	6 miles north of Denton	7
Arrow Creek	Fergus	5 miles north of Denton	8
Wolf Creek	Fergus	8 miles east of Denton	9
Dry Wolf Creek	Fergus	nr confluence	10
Dog Creek	Fergus	5 miles south of Winifred	11
Montana Valley & Foothill Prairies (#16)			
Elk Creek	Lewis & Clark	nr mouth	4
Duck Creek	Teton	T20N R3W sec27	6
Jerry Creek	Silver Bow	1.2 miles above mouth	21
Pintlar Creek	Beaverhead	near mouth	17
Birch Creek	Beaverhead	above first diversion	19
Mussigbrod Creek	Beaverhead	T1S R16W sec22	20
Big Pipestone Creek	Jefferson	near mouth	24
Ruby River	Madison	below west road bridge	30
Cottonwood Creek	Fergus	below Hiway 200	13
Beaver Creek	Fergus	below Hiway 87	14

Table 2. Metrics and scoring criteria for 300 organism RBP kick samples from plains, foothill and valley, and mountain streams in Montana.

Plains	Scoring Criteria			
metric	6	4	2	0
Taxa richness	>24	24 - 18	18 - 12	<12
EPT richness	>7	7 - 6	5 - 4	<4
Biotic index	<6	6 - 7	7 - 8	>8
% dominant taxon	<30	30-40	40-50	>50
% Collector-FFG	<70	70-85	85-95	>95
% EPT	>35	35-20	20- 5	<5

Foothill & Valley	Scoring Criteria			
metric	6	4	2	0
Taxa richness	>28	28-21	21-14	<14
EPT richness	>14	14-13	12 - 11	<11
Biotic index	<4	4 - 5	5 - 6	>6
% dominant taxon	<30	30-40	40-50	>50
% Collector-FFG	<60	60-75	75-90	>90
% Scrapers+Shredders	>30	30-20	20-10	<10
Hydropsychinae/Trichoptera	0.75	0.75-0.85	0.85-0.95	>0.95
% EPT	>60	60-45	45-30	<30

Mountain	Scoring Criteria			
metric	6	4	2	0
Taxa richness	>28	28-24	24-19	<19
EPT richness	>19	19-18	17-16	<16
Biotic index	<3	3 - 4	4 - 5	>5
% dominant taxon	<25	25-35	35-45	>45
% Collector-FFG	<60	60-70	70-80	>80
% Scrapers+Shredders	>55	55-40	40-25	<25
% EPT	>70	70-55	55-40	<40

Table 3. Criteria for the assessment of biologically significant environmental degradation (from Plafkin et al 1989).

% comp. to reference	Classification
>83%	nonimpaired
54-79%	slightly impaired
21-50%	moderately impaired
<17%	severely impaired

Table 4. Stream and riparian habitat assessment (riffle/run prevalence).

Location:	Montana: statewide NPS stream assessments.					
Stream:	Mussigbrod	Wise R.	Birch Cr.	Basin Cr	Boulder R.	B. Pipestone
County:	Beaverhead	Beaverhead	Beaverhead	Jefferson	Jefferson	Jefferson
Date:	Aug-94	Sep-94	Aug-94	Aug-94	Oct-94	Sep-94
Evaluator:	OEA- M.R.	OEA - M.R.	OEA - S.G.	OEA - C.D.	OEA - K.K.	OEA
Parameter						
P riffle dev/substrate	14	18	18	7	10	7
P embeddedness	16	18	16	12	12	2
P discharge/vel&depth	16	13	6	6	13	6
S channel alteration	10	9	8	4	8	8
S sediment deposition	12	11	11	7	7	4
S riffle frequency	13	14	12	7	9	4
S flow status	10	5	12	7	8	5
T bank condition	9	8	8	5	7	6
T vegetation protection	10	10	8	3	8	6
T grazing/disturbance	8	8	6	2	9	8
T riparian width	8	8	7	2	4	6
total score	126	122	112	62	95	62
percentage	79%	76%	70%	39%	59%	39%
classification	Opt./Subopt	Sub-opt.	Sub-opt.	Marginal	Sub-opt.	Marginal
Mean values						
Primary	15.3	16.3	13.3	8.3	11.7	5.0
Secondary	11.3	9.8	10.8	6.3	8.0	5.3
Tertiary	8.8	8.5	7.3	3.0	7.0	6.5
means total	35	35	31	18	27	17

Maximum possible score = 160. Categories: Optimal >133, Sub-optimal 122 - 90, Marginal 78 - 46,

Table 4. Stream and riparian habitat assessment (riffle/run prevalence). [concluded]

Location:	Montana: statewide NPS stream assessments.					
Stream:	Beaver Cr	Elk Cr.	Dry F. Belt	Crow Cr.	Cottonwood	Beaver Cr.
County:	Lewis&Clark	Lewis&Clark	Cascade	Broadwater	Fergus	Fergus
Date:	Jun-94	Sep-94	Jun-94	Jun-94	Sep-94	Sep-94
Evaluator:	OEA - M.R.	OEA - C.F.	OEA - M.R.	OEA - M.R.	OEA - S.G.	OEA - S.G.
Parameter						
P riffle dev/substrate	15	16	20	14	18	18
P embeddedness	15	16	18	13	11	10
P discharge/vel&depth	16	16	15	8	12	11
S channel alteration	14	9	15	9	11	10
S sediment deposition	14	11	14	8	9	7
S riffle frequency	14	12	14	12	9	7
S flow status	15	7	14	9	6	10
T bank condition	6	7	8	7	6	7
T vegetation protection	7	8	8	6	5	7
T grazing/disturbance	9	7	9	3	6	7
T riparian width	6	7	7	2	5	4
total score	131	116	142	91	98	98
percentage	82%	73%	89%	57%	61%	61%
classification	Opt./Subopt	Sub-opt.	Optimal	Sub-opt.	Sub-opt.	Sub-opt.
Mean values						
Primary	15.3	16.0	17.7	11.7	13.7	13.0
Secondary	14.3	9.8	14.3	9.5	8.8	8.5
Tertiary	7.0	7.3	8.0	4.5	5.5	6.3
means total	37	33	40	26	28	28

Maximum possible score = 160. Categories: Optimal >133, Sub-optimal 122 - 90, Marginal 78 - 46,

Table 5. Stream and riparian habitat assessment (glide/pool prevalence).

Location:	Statewide stream survey, Montana							
Stream:	Nelson Cr.	Timber Cr.	Pintler Cr.	Arrow Cr.	Dog Cr.	Coffee Cr	Dry Wolf	W
County:	McCone	McCone	Beaverhead	Fergus	Fergus	Fergus	Fergus	F
Date:	Jul-94	Jul-94	Aug-94	Sep-94	Sep-94	Sep-94	Sep-94	S
Evaluator:	OEA-S.G.	OEA-S.G.	OEA	OEA - S.G.	OEA - S.G.	OEA - S.G.	OEA - S.G.	OE
Parameter								
instream cover	3	7	9	10	16	6	8	
epifaunal substrate	3	11	12	10	8	7	5	
pool substrate	11	15	15	12	13	7	12	
pool variability	13	11	14	9	13	11	5	
channel alteration	18	16	16	13	13	12	16	
sediment deposition	8	11	12	13	13	8	8	
sinuosity	10	10	14	11	13	13	13	
flow status	3	6	13	11	6	8	8	
bank condition	10	11	16	12	12	8	8	
bank vegetation	8	8	18	11	8	8	8	
grazing/disturbance	14	14	17	13	13	11	11	
riparian width	11	11	20	8	10	5	8	
total score	112	131	176	133	138	104	110	
percentage	47%	55%	73%	55%	58%	43%	46%	
classification	Marginal	Sub-opt.	Sub-opt.	Sub-opt.	Sub-opt.	Marginal	Marginal	Ma

Maximum possible score = 240, classification categories: Optimal >191, Sub-optimal 180 - 132, Ma

Table 6. Metric values and bioassessments for 11 streams in Montana Plains ecoregio

metric	stream							
	Careless	Yellow Wat.	Flatwillow	Big Coulee	Coffee	Arrow	Wolf	Dry
Taxa richness	20	18	12	28	14	29	26	1
EPT richness	7	3	4	10	0	11	3	
Biotic index	5.2	6.9	2.9	5.9	7.9	5.3	7.0	7
% dominant taxon	22	48	73	22	91	19	41	4
% Collector-FFG	60	82	92	89	97	83	68	8
% EPT	33	49	83	42	0	69	44	
	metric score							
Taxa richness	4	3	2	6	2	6	6	
EPT richness	4	0	2	6	0	6	0	
Biotic index	6	4	6	6	2	6	3	
% dominant taxon	6	2	0	6	0	6	2	
% Collector-FFG	6	4	2	2	0	4	6	
% EPT	4	6	6	6	0	6	6	
total score	30	19	18	32	4	34	23	1
% of reference	83%	53%	50%	89%	11%	94%	64%	3
classification *	NON	SLI/MOD	MOD	NON	SEV	NON	SLI	M

* classifications: (NON) nonimpaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely imp

Table 7. Metric values and bioassessments for ten streams in Montana Valley and Footl during 1994.

	stream						
metric	Jerry	Pintlar	Ruby R.	B Pipestone	Mussigbrod	Birch	Duck
Taxa richness	20	31	36	16	27	32	22
EPT richness	9	3	13	8	11	16	8
Biotic index	3.7	6.0	5.0	5.6	4.5	2.9	6.8
% dominant taxon	47	30	14	33	21	10	30
% Collector-FFG	45	57	84	99	82	63	90
% Scraper+ Shredder	4	5	9	0	10	29	8
Hydropsychinae/Trich	0	0	76	99	68	0	59
% EPT	14	7	45	65	30	53	18
					metric score		
Taxa richness	2	6	6	2	4	6	4
EPT richness	0	0	4	0	2	6	0
Biotic index	6	2	3	2	4	6	0
% dominant taxon	2	4	6	4	6	6	4
% Collector-FFG	6	6	2	0	2	4	2
% Scraper + Shredder	0	0	0	0	2	4	0
Hydropsychinae/Trich	6	0	4	0	6	6	6
% EPT	0	0	3	6	2	4	0
total score	22	18	28	14	28	42	16
% of reference	46%	38%	58%	29%	58%	88%	33%
classification *	MOD	MOD	SLI	MOD	SLI	NON	MOD

* classifications: (NON) nonimpaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impa

Table 8. Metric values and bioassessments for six streams in Montana mountain ecoregions during 1994.

metric	stream					
	Crow	Beaver	DryF Belt	Birch	Basin	Wise River
Taxa richness	15	26	12	32	31	27
EPT richness	7	12	7	16	18	11
Biotic index	2.5	4.4	1.6	2.9	4.1	4.1
% dominant taxon	41	30	27	10	19	14
% Collector-FFG	45	80	12	63	75	66
% Scrapers + Shredders	51	6	33	29	18	29
% EPT	55	58	86	53	47	39
	metric score					
Taxa richness	0	4	0	6	6	4
EPT richness	0	0	0	2	4	0
Biotic index	6	2	6	6	2	2
% dominant taxon	2	4	4	6	6	6
% Collector-FFG	6	2	6	4	2	4
% Scrapers + Shredders	4	0	2	2	0	2
% EPT	3	4	6	2	2	0
total score	21	16	24	28	22	18
% of reference	50%	38%	57%	67%	52%	43%
classification *	MOD	MOD	SLI	SLI	SLI/MOD	MOD

* classifications: (NON) nonimpaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impa

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Appendix A.1. Plains ecoregion aquatic macroinvertebrate checklist with tolerance values for biotic index (BI), metals tolerance index (MTI) and functional feeding group (FFG) designations.

Taxon	BI	MTI	FFG
COLEOPTERA			
Elmidae			
Cleptelmis sp.	4	4	c-gathererer
Dubiraphia sp.	6	4	c-gathererer
Microcylloepus sp.	5	3	c-gathererer
Optioservus sp.	5	5	c-gathererer
Ziatzevia sp.	4	3	c-gathererer
Curclionidae	5		shredder
Dytiscidae	5	7	predator
Hydrophilidae			
Helophorus sp.	5	3	c-gathererer
Haliplidae			
Haliplus sp.	5	5	shredder
DIPTERA			
Chironomidae			
Ablabesmyia sp.	8	3	predator
Larsia sp.	6	3	predator
Procladius sp.	9	5	predator
Thienemannimyia gp.	5	4	predator
Zavrelimyia sp.	8	3	predator
Potthastia longimanus gp.	2	5	c-gatherer
Cricotopus spp.	7	9	c-gatherer
Eukiefferiella spp.	8	9	c-gatherer
Nanocladius sp.	3	4	c-gatherer
Orthocladius spp.	6	5	c-gatherer
Paraphaenocladius sp.	4	4	c-gatherer
Psuedosmittia sp.	6	3	c-gatherer
Tvetenia sp.	5	4	c-gatherer
Chironomus sp.	10	4	c-gatherer
Cryptochironomus sp.	8	4	c-gatherer
Cryptotendipes sp.	6	4	c-gatherer
Dicrotendipes sp.	8	5	c-gatherer
Einfeldia sp.	9	4	c-gatherer
Polypedilum sp.	6	4	c-gatherer
Micropsectra sp.	4	1	c-gatherer
Cladotanytarsus sp.	7	3	c-gatherer
Paratanytarsus sp.	6	2	c-gatherer
Rheotanytarsus sp.	6	1	filterer
Tabanidae	6	3	predator
Tipulidae			
Dicranota sp.	3	2	predator
Tipula sp.	4	4	shredder
Empididae	6	4	predator

Appendix A.1. Plains ecoregion aquatic macroinvertebrate checklist with tolerance values for biotic index (BI), metals tolerance index (MTI) and functional feeding group (FFG) designations.

Taxon	BI	MTI	FFG
Stratiomyidae			
Stratiomyia sp.	7	3	c-gatherer
Psychodidae			
Pericoma sp.	4	4	c-gatherer
Psychoda sp.	10	4	c-gatherer
Dolichopodidae	4	4	predator
Muscidae	9	5	predator
Limnophora sp.	6	7	predator
Simulidae			
Simulium (Psilozoa) sp.	7	7	filterer
Ceratopogoninae	6	4	predator
EPHEMEROPTERA			
Baetidae			
Baetis tricaudatus	4	5	c-gatherer
Callibaetis sp.	9	1	c-gatherer
Ephemerellidae			
Ephemerella inermis	4	3	c-gatherer
Caenidae			
Caenis sp.	7	3	c-gatherer
Heptageniidae			
Heptagenia sp.	4	1	scraper
Stenonema sp.	3.5	1	scraper
Leptophlebiidae			
Choroterpes a.	2	1	c-gatherer
Leptophlebia sp.	3	1	c-gatherer
Paraleptophlebia bicornuta	2	1	c-gatherer
Tricorythidae			
Tricorythodes sp.	4	4	c-gatherer
PLECOPTERA			
NeNemouridae			
Malenka sp.	1	1	shredder
TRICHOPTERA			
Hydropsychidae			
Cheumatopsyche sp.	5	5	filterer
Ceratopsyche spp.	5	5	filterer
Hydropsyche occidentalis	5	5	filterer
Brachycentridae			
Brachycentrus occidentalis	2	3	c-gatherer
Hydroptilidae			
Hydroptila sp.	6	4	c-gatherer
Leptoceridae			
Oecetis sp.	8	3	predator
Limnephilidae			
Limnophilus sp.	3	2	shredder

Appendix A.1. Plains ecoregion aquatic macroinvertebrate checklist with tolerance values for biotic index (BI), metals tolerance index (MTI) and functional feeding group (FFG) designations.

Taxon	BI	MTI	FFG
HEMIPTERA			
Naucoridae			
Ambrysus sp.	3	3	predator
Notonectidae			
Notonecta sp.	5	3	predator
Corrixidae	5	3	predator
Belostomatidae			
Lethocerus sp.	5?		predator
ODONATA			
Gomphidae			
Octogomphus sp.	5	3	predator
Ophiogomphus sp.	5	4	predator
Coenagrionidae			
Amphiagrion sp.	7	3	predator
Ischnura sp.	7	3	predator
Enallagma sp.	7	3	predator
MEGALOPTERA			
Sialis sp.	4	4	predator
CRUSTACEA			
Gammarus sp.	4	1	shredder
Hyalella azteca	8	3	c-gatherer
MOLLUSCA			
Gyraulus sp.	8	3	scraper
Lymnaeidae	6	3	scraper
Physidae	8	3	scraper
ANNELIDA			
Glossiphoniidae			
Helobdella stagnalis	10	4	predator
Erpobdellidae	8	4	predator
Naididae	8	5	c-gatherer
Tubificidae	10	6	c-gatherer
Cnidaria			
Hydra sp.	8	3	predator

APPENDIX A.2

Macroinvertebrate data
plains streams 1994

raw data and metrics

Careless Creek

Yellow Water Creek

Flatwillow Creek

Big Coulee

Coffee Creek

Arrow Creek

Wolf Creek

Dry Wolf Creek

Dog Creek

Nelson Creek

Timber Creek

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Careless Creek - Golden Valley Co. - 9/9/94
RBP kick sample - 60 sec/10 ft entire sample used

Taxon	Number	%RA
COLEOPTERA		
Cleptelmis sp.	6	4.3%
Dubiraphia sp.	4	2.8%
Optioservus sp.	21	14.9%
Ziatzevia sp.	6	4.3%
DIPTERA		
Larsia sp.	5	3.5%
Nanocladius sp.	1	0.7%
Tipula sp.	10	7.1%
EPHEMEROPTERA		
Callibaetis sp.	1	0.7%
Caenis sp.	1	0.7%
Leptophlebia sp.	31	22.0%
Paraleptophlebia bicornuta	5	3.5%
Tricorythodes sp.	3	2.1%
PLECOPTERA		
Malenka sp.	3	2.1%
TRICHOPTERA		
Oecetis sp.	2	1.4%
HEMIPTERA		
Sigara sp.	1	0.7%
CRUSTACEA		
Hyalella azteca	15	10.6%
MOLLUSCA		
Physidae	2	1.4%
ANNELIDA		
Helobdella stagnalis	1	0.7%
Naididae	22	15.6%
OTHER		
Hydra sp.	1	0.7%

ID's by D. McGuire

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Careless Creek - Golden Valley Co. - 9/9/94
RBP kick sample - 60 sec/10 ft entire sample used

TOTAL ORGANISMS	141
TAXA RICHNESS	20
EPT RICHNESS	7
BIOTIC INDEX	5.21
METALS TOL. INDEX	3.06
% EPT	33%
% Chironomidae	4%
% DOMINANT TAXON	22%
% COLLECTOR (gatherer+filterer)	60%
% SCRAPER + SHREDDER	33%
Shannon Diversity	3.51
% COLLECTOR-GATHERERS	60%
% SHREDDERS	31%
% SCRAPERS	1%
% FILTERERS	0%
% PREDATORS	7%
% COLEOPTERA	26%
% DIPTERA	11%
% EPHEMEROPTERA	29%
% PLECOPTERA	2%
% TRICHOPTERA	1%
% misc INSECTS	1%
% ANNELIDA	16%
% MOLLUSCA	1%
% CRUSTACEA	11%
% misc NONINSECTS	1%
Baetidae/EPHEMEROPTERA	2%
Hydropsychinae/TRICH	0%

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Yellow Water Creek - Petroleum Co. - 9/7/94
RBP kick sample - 60 sec/15 ft - 80% of sample used

Taxon	Number	%RA
COLEOPTERA		
Dubiraphia sp.	1	0.3%
DIPTERA		
Ablabesmyia sp.	1	0.3%
Cricotopus/Orthocladius spp.	10	3.4%
Cryptotendipes sp.	2	0.7%
Dicrotendipes sp.	29	9.8%
Einfeldia sp.	1	0.3%
Paratanytarsus sp.	51	17.2%
Ceratopogoninae	3	1.0%
EPHEMEROPTERA		
Callibaetis sp.	2	0.7%
Caenis sp.	143	48.1%
TRICHOPTERA		
Cheumatopsyche sp.	1	0.3%
HEMIPTERA		
Sigara sp.	2	0.7%
ODONATA		
Octogomphus sp.	3	1.0%
Ischnura/Enallagma sp.	33	11.1%
MEGALOPTERA		
Sialis sp.	1	0.3%
CRUSTACEA		
Hyalella azteca	3	1.0%
MOLLUSCA		
Physidae	10	3.4%
ANNELIDA		
Tubificidae	1	0.3%

ID's by D. McGuire

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Yellow Water Creek - Petroleum Co. - 9/7/94
RBP kick sample - 60 sec/15 ft - 80% of sample used

TOTAL ORGANISMS	297
TAXA RICHNESS	18
EPT RICHNESS	3
BIOTIC INDEX	6.94
METALS TOL. INDEX	3.19
% EPT	49%
% Chironomidae	32%
% DOMINANT TAXON	48%
% COLLECTOR (gatherer+filterer)	82%
% SCRAPER + SHREDDER	3%
Shannon Diversity	2.47
% COLLECTOR-GATHERERS	82%
% SHREDDERS	0%
% SCRAPERS	3%
% FILTERERS	0%
% PREDATORS	14%
% COLEOPTERA	0%
% DIPTERA	33%
% EPHEMEROPTERA	49%
% PLECOPTERA	0%
% TRICHOPTERA	0%
% misc INSECTS	13%
% ANNELIDA	0%
% MOLLUSCA	3%
% CRUSTACEA	1%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	1%
Hydropsychinae/TRICH	100%

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Flatwillow Creek - Petroleum Co. - 9/7/94
RBP kick sample - 60 sec/15 ft - entire sample used

Taxon	Number	%RA
COLEOPTERA		
Microcylloepus pus.	5	4.0%
DIPTERA		
Ablabesmyia sp.	2	1.6%
Cricotopus spp.	1	0.8%
Chironomus sp.	1	0.8%
Dicrotendipes sp.	3	2.4%
EPHEMEROPTERA		
Baetis sp.	1	0.8%
Choroterpes a.	90	72.6%
TRICHOPTERA		
Cheumatopsyche sp.	11	8.9%
Ceratopsyche spp.	1	0.8%
HEMIPTERA		
Ambrysus sp.	6	4.8%
Sigara sp.	2	1.6%
ANNELIDA		
Tubificidae	1	0.8%

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AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Flatwillow Creek - Petroleum Co. - 9/7/94
RBP kick sample - 60 sec/15 ft - entire sample used

TOTAL ORGANISMS	124
TAXA RICHNESS	12
EPT RICHNESS	4
BIOTIC INDEX	2.94
METALS TOL. INDEX	1.88
% EPT	83%
% Chironomidae	6%
% DOMINANT TAXON	73%
% COLLECTOR (gatherer+filterer)	92%
% SCRAPER + SHREDDER	0%
Shannon Diversity	1.65
% COLLECTOR-GATHERERS	82%
% SHREDDERS	0%
% SCRAPERS	0%
% FILTERERS	10%
% PREDATORS	8%
% COLEOPTERA	4%
% DIPTERA	6%
% EPHEMEROPTERA	73%
% PLECOPTERA	0%
% TRICHOPTERA	10%
% misc INSECTS	6%
% ANNELIDA	1%
% MOLLUSCA	0%
% CRUSTACEA	0%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	1%
Hydropsychinae/TRICH	100%

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Big Coulee - Teton Co. - 10/3/94
RBP kick sample - 60 sec/5 ft - 50% of sample used

Taxon	Number	%RA
COLEOPTERA		
Optioservus sp.	1	0.3%
Ziatzevia sp.	1	0.3%
DIPTERA		
Thienemannimyia gp.	7	2.4%
Potthastia longimanus gp.	1	0.3%
Cricotopus spp.	63	21.8%
Eukiefferiella spp.	1	0.3%
Orthocladius spp.	27	9.3%
Tvetenia sp.	1	0.3%
Chironomus sp.	1	0.3%
Rheotanytarsus sp.	4	1.4%
Dicranota sp.	10	3.5%
Limnophora sp.	1	0.3%
Simulium sp. (Psilozoa)	6	2.1%
EPHEMEROPTERA		
Baetis tricaudatus	2	0.7%
Caenis sp.	6	2.1%
Heptagenia sp.	8	2.8%
Stenonema sp.	3	1.0%
Tricorythodes sp.	2	0.7%
TRICHOPTERA		
Cheumatopsyche sp.	24	8.3%
Ceratopsyche spp.	9	3.1%
Hydropsyche occidentalis	60	20.8%
Hydroptila sp.	1	0.3%
Brachycentrus occidentalis	6	2.1%
ODONATA		
Ophiogomphus sp.	1	0.3%
CRUSTACEA		
Hyalella azteca	38	13.1%
MOLLUSCA		
Physidae	1	0.3%
ANNELIDA		
Naididae	1	0.3%
Tubificidae	3	1.0%
ID's by D. McGuire		

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Big Coulee - Teton Co. - 10/3/94
RBP kick sample - 60 sec/5 ft - 50% of sample used

TOTAL ORGANISMS	289
TAXA RICHNESS	28
EPT RICHNESS	10
BIOTIC INDEX	5.93
METALS TOL. INDEX	5.18
% EPT	42%
% Chironomidae	36%
% DOMINANT TAXON	22%
% COLLECTOR (gatherer+filterer)	89%
% SCRAPER + SHREDDER	4%
Shannon Diversity	3.53
% COLLECTOR-GATHERERS	52%
% SHREDDERS	0%
% SCRAPERS	4%
% FILTERERS	38%
% PREDATORS	7%
% COLEOPTERA	1%
% DIPTERA	42%
% EPHEMEROPTERA	7%
% PLECOPTERA	0%
% TRICHOPTERA	35%
% misc INSECTS	0%
% ANNELIDA	1%
% MOLLUSCA	0%
% CRUSTACEA	13%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	10%
Hydropsychinae/TRICH	93%

Ecoregion: Northwestern Great Plains
fauna more typical of valleys & foothills

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Coffee Creek - Fergus Co. - 6/20/94
RBP kick sample - 60 sec/5 ft - 25% of sample used

Taxon	Number	%RA
COLEOPTERA		
Optioservus sp.	1	0.3%
Curclionidae	2	0.7%
Dytiscidae	1	0.3%
Helophorus sp.	1	0.3%
DIPTERA		
Cricotopus spp.	3	1.0%
Stratiomyia sp.	1	0.3%
Pericoma sp.	3	1.0%
Dolichopodidae	3	1.0%
Muscidae	3	1.0%
CRUSTACEA		
Gammarus sp.	1	0.3%
Hyalella azteca	278	91.4%
MOLLUSCA		
Fossaria sp.	2	0.7%
Physidae	1	0.3%
ANNELIDA		
Tubificidae	4	1.3%

ID's by D. McGuire

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Coffee Creek - Fergus Co. - 6/20/94
RBP kick sample - 60 sec/5 ft - 25% of sample used

TOTAL ORGANISMS	304
TAXA RICHNESS	14
EPT RICHNESS	0
BIOTIC INDEX	7.87
METALS TOL. INDEX	3.15
% EPT	0%
% Chironomidae	1%
% DOMINANT TAXON	91%
% COLLECTOR (gatherer+filterer)	97%
% SCRAPER + SHREDDER	1%
Shannon Diversity	0.72
% COLLECTOR-GATHERERS	97%
% SHREDDERS	0%
% SCRAPERS	1%
% FILTERERS	0%
% PREDATORS	1%
% COLEOPTERA	2%
% DIPTERA	4%
% EPHEMEROPTERA	0%
% PLECOPTERA	0%
% TRICHOPTERA	0%
% misc INSECTS	0%
% ANNELIDA	1%
% MOLLUSCA	1%
% CRUSTACEA	92%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	#REF!
Hydropsychinae/TRICH	#REF!

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Arrow Creek - Fergus Co. - 6/20/94
RBP kick sample - 60 sec/5 ft - 25% of sample used

Taxon	Number	%RA
COLEOPTERA		
Dubiraphia sp.	1	0.3%
Optioservus sp.	5	1.7%
DIPTERA		
Thienemannimyia gp.	8	2.7%
Zavrelimyia sp.	1	0.3%
Cricotopus spp.	5	1.7%
Orthocladius spp.	7	2.4%
Paraphaenocladius sp.	1	0.3%
Rheotanytarsus sp.	16	5.5%
Dicranota sp.	1	0.3%
Tipula sp.	15	5.2%
Empididae	1	0.3%
Pericoma sp.	5	1.7%
Ceratopogoninae	4	1.4%
EPHEMEROPTERA		
Baetis tricaudatus	9	3.1%
Ephemerella inermis	2	0.7%
Caenis sp.	43	14.8%
Leptophlebia sp.	38	13.1%
Tricorythodes sp.	4	1.4%
PLECOPTERA		
Skwala sp.	1	0.3%
TRICHOPTERA		
Cheumatopsyche sp.	56	19.2%
Ceratopsyche spp.	20	6.9%
Hydropsyche occidentalis	25	8.6%
Hydroptila sp.	1	0.3%
Limnophilus sp.	1	0.3%
ODONATA		
Ischnura sp.	4	1.4%
CRUSTACEA		
Hyalella azteca	3	1.0%

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Arrow Creek - Fergus Co. - 6/20/94
RBP kick sample - 60 sec/5 ft - 25% of sample used

MOLLUSCA		
Physidae	12	4.1%
ANNELIDA		
Erpobdellidae	1	0.3%
Tubificidae	1	0.3%

ID's by D. McGuire

TOTAL ORGANISMS	291
TAXA RICHNESS	29
EPT RICHNESS	11
BIOTIC INDEX	5.25
METALS TOL. INDEX	3.71
% EPT	69%
% Chironomidae	13%
% DOMINANT TAXON	19%
% COLLECTOR (gatherer+filterer)	83%
% SCRAPER + SHREDDER	10%
Shannon Diversity	3.84
% COLLECTOR-GATHERERS	43%
% SHREDDERS	5%
% SCRAPERS	4%
% FILTERERS	40%
% PREDATORS	7%
% COLEOPTERA	2%
% DIPTERA	22%
% EPHEMEROPTERA	33%
% PLECOPTERA	0%
% TRICHOPTERA	35%
% misc INSECTS	1%
% ANNELIDA	1%
% MOLLUSCA	4%
% CRUSTACEA	1%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	9%
Hydropsychinae/TRICH	98%

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Wolf Creek - Fergus Co. - 9/20/94
RBP kick sample - 60 sec/10 ft - entire sample used

Taxon	Number	%RA
COLEOPTERA		
Dubiraphia sp.	7	2.3%
Optioservus sp.	1	0.3%
Dytiscidae	2	0.7%
Haliplus sp.	4	1.3%
DIPTERA		
Procladius sp.	1	0.3%
Thienemannimyia gp.	2	0.7%
Cricotopus spp.	2	0.7%
Orthocladius spp.	13	4.3%
Cryptochironomus sp.	1	0.3%
Dicrotendipes sp.	2	0.7%
Micropsectra sp.	2	0.7%
Tabanidae	6	2.0%
Empididae	1	0.3%
Simulium sp. (Psilozoa)	7	2.3%
EPHEMEROPTERA		
Callibaetis sp.	1	0.3%
Caenis sp.	122	40.5%
TRICHOPTERA		
Cheumatopsyche sp.	9	3.0%
HEMIPTERA		
Ambrysus sp.	2	0.7%
Notonecta sp.	1	0.3%
Sigara sp.	8	2.7%
ODONATA		
Ophiogomphus sp.	1	0.3%
Enallagma sp.	35	11.6%
CRUSTACEA		
Hyalella azteca	32	10.6%
MOLLUSCA		
Gyraulus sp.	5	1.7%
Physidae	32	10.6%
ANNELIDA		
Tubificidae	2	0.7%

ID's by D. McGuire

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Wolf Creek - Fergus Co. - 9/20/94
RBP kick sample - 60 sec/10 ft - entire sample used

TOTAL ORGANISMS	301
TAXA RICHNESS	26
EPT RICHNESS	3
BIOTIC INDEX	6.96
METALS TOL. INDEX	3.40
% EPT	44%
% Chironomidae	8%
% DOMINANT TAXON	41%
% COLLECTOR (gatherer+filterer)	68%
% SCRAPER + SHREDDER	12%
Shannon Diversity	3.14
% COLLECTOR-GATHERERS	63%
% SHREDDERS	0%
% SCRAPERS	12%
% FILTERERS	5%
% PREDATORS	20%
% COLEOPTERA	5%
% DIPTERA	12%
% EPHEMEROPTERA	41%
% PLECOPTERA	0%
% TRICHOPTERA	3%
% misc INSECTS	16%
% ANNELIDA	1%
% MOLLUSCA	12%
% CRUSTACEA	11%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	1%
Hydropsychinae/TRICH	100%

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Dry Wolf Creek - Fergus Co. - 9/20/94
RBP kick sample - 60 sec/10 ft - 100% of sample used

Taxon	Number	%RA
COLEOPTERA		
Dytiscidae	2	0.8%
Haliplus sp.	1	0.4%
Hydrophilidae	1	0.4%
DIPTERA		
Cricotopus spp.	1	0.4%
Psuedosmittia sp.	2	0.8%
Paratanytarsus sp.	15	6.2%
Tabanidae	4	1.6%
EPHEMEROPTERA		
Callibaetis sp.	3	1.2%
Caenis sp.	2	0.8%
TRICHOPTERA		
Limnophilus sp.	1	0.4%
HEMIPTERA		
Corrixidae (2 genera)	44	18.1%
ODONATA		
Amphiagrion sp.	23	9.5%
Enallagma sp.	25	10.3%
CRUSTACEA		
Hyalella azteca	102	42.0%
ANNELIDA		
Tubificidae	17	7.0%

ID's by D. McGuire

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Dry Wolf Creek - Fergus Co. - 9/20/94
RBP kick sample - 60 sec/10 ft - 100% of sample used

TOTAL ORGANISMS	243
TAXA RICHNESS	15
EPT RICHNESS	3
BIOTIC INDEX	7.16
METALS TOL. INDEX	3.19
% EPT	2%
% Chironomidae	7%
% DOMINANT TAXON	42%
% COLLECTOR (gatherer+filterer)	59%
% SCRAPER + SHREDDER	0%
Shannon Diversity	2.63
% COLLECTOR-GATHERERS	59%
% SHREDDERS	0%
% SCRAPERS	0%
% FILTERERS	0%
% PREDATORS	40%
% COLEOPTERA	2%
% DIPTERA	9%
% EPHEMEROPTERA	2%
% PLECOPTERA	0%
% TRICHOPTERA	0%
% misc INSECTS	38%
% ANNELIDA	7%
% MOLLUSCA	0%
% CRUSTACEA	42%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	60%
Hydropsychinae/TRICH	0%

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Dog Creek - Fergus Co. - 9/19/94
RBP kick sample - 60 sec/10 ft - 100% of sample used

Taxon	Number	%RA
COLEOPTERA		
Dubiraphia sp.	2	4.3%
Dytiscidae	1	2.1%
Haliplus sp.	1	2.1%
DIPTERA		
Procladius sp.	1	2.1%
Tabanidae	3	6.4%
Psychoda sp.	1	2.1%
EPHEMEROPTERA		
Caenis sp.	13	27.7%
TRICHOPTERA		
Brachycentrus occidentalis	1	2.1%
HEMIPTERA		
Lethocerus sp.	1	2.1%
Sigara sp.	3	6.4%
ODONATA		
Enallagma sp.	1	2.1%
CRUSTACEA		
Hyalella azteca	1	2.1%
MOLLUSCA		
Physidae	1	2.1%
ANNELIDA		
Tubificidae	17	36.2%

ID's by D. McGuire

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Dog Creek - Fergus Co. - 9/19/94
RBP kick sample - 60 sec/10 ft - 100% of sample used

TOTAL ORGANISMS	47
TAXA RICHNESS	14
EPT RICHNESS	2
BIOTIC INDEX	7.72
METALS TOL. INDEX	4.36
% EPT	30%
% Chironomidae	2%
% DOMINANT TAXON	36%
% COLLECTOR (gatherer+filterer)	77%
% SCRAPER + SHREDDER	2%
Shannon Diversity	2.81
% COLLECTOR-GATHERERS	74%
% SHREDDERS	0%
% SCRAPERS	2%
% FILTERERS	2%
% PREDATORS	21%
% COLEOPTERA	9%
% DIPTERA	11%
% EPHEMEROPTERA	28%
% PLECOPTERA	0%
% TRICHOPTERA	2%
% misc INSECTS	11%
% ANNELIDA	36%
% MOLLUSCA	2%
% CRUSTACEA	2%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	#REF!
Hydropsychinae/TRICH	0%

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Timber Creek - McCone Co. - 7/12/94
RBP kick sample - 60 sec/10 ft - 100% of sample used

Taxon	Number	%RA
COLEOPTERA		
Dubiraphia sp.	1	0.4%
DIPTERA		
Ablabesmyia sp.	10	4.2%
Larsia sp.	1	0.4%
Dicrotendipes sp.	14	5.9%
Cladotanytarsus sp.	8	3.4%
Tabanidae	1	0.4%
EPHEMEROPTERA		
Callibaetis sp.	9	3.8%
Caenis sp.	154	65.3%
HEMIPTERA		
Corrixidae	27	11.4%
ODONATA		
Gomphidae	5	2.1%
Ischnura sp.	3	1.3%
MEGALOPTERA		
Sialis sp.	1	0.4%
ANNELIDA		
Tubificidae	2	0.8%

ID's by D. McGuire

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Timber Creek - McCone Co. - 7/12/94
RBP kick sample - 60 sec/10 ft - 100% of sample used

TOTAL ORGANISMS	236
TAXA RICHNESS	13
EPT RICHNESS	2
BIOTIC INDEX	6.91
METALS TOL. INDEX	3.08
% EPT	69%
% Chironomidae	14%
% DOMINANT TAXON	65%
% COLLECTOR (gatherer+filterer)	80%
% SCRAPER + SHREDDER	0%
Shannon Diversity	1.93
% COLLECTOR-GATHERERS	80%
% SHREDDERS	0%
% SCRAPERS	0%
% FILTERERS	0%
% PREDATORS	20%
% COLEOPTERA	0%
% DIPTERA	14%
% EPHEMEROPTERA	69%
% PLECOPTERA	0%
% TRICHOPTERA	0%
% misc INSECTS	15%
% ANNELIDA	1%
% MOLLUSCA	0%
% CRUSTACEA	0%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	6%
Hydropsychinae/TRICH	#REF!

AQUATIC MACROINVERTEBRATE DATA - 1994 STATEWIDE STREAM SURVEYS
Nelson Creek - McCone Co. - 8/10/94
RBP kick sample - 60 sec/30 ft - no flow - 100% of sample used

Taxon	Number	%RA
DIPTERA		
Chironomus sp.	1	9.1%
Polypedilum sp.	2	18.2%
Cladotanytarsus sp.	6	54.5%
HEMIPTERA		
Corrixidae	2	18.2%

ID's by D. McGuire

TOTAL ORGANISMS	11
TAXA RICHNESS	4
EPT RICHNESS	0
BIOTIC INDEX	6.73
METALS TOL. INDEX	3.27
% EPT	0%
% Chironomidae	82%
% DOMINANT TAXON	55%
% COLLECTOR (gatherer+filterer)	82%
% SCRAPER + SHREDDER	0%
Shannon Diversity	1.69
% COLLECTOR-GATHERERS	82%
% SHREDDERS	0%
% SCRAPERS	0%
% FILTERERS	0%
% PREDATORS	18%
% COLEOPTERA	0%
% DIPTERA	82%
% EPHEMEROPTERA	0%
% PLECOPTERA	0%
% TRICHOPTERA	0%
% misc INSECTS	18%
% ANNELIDA	0%
% MOLLUSCA	0%
% CRUSTACEA	0%
% misc NONINSECTS	0%
Baetidae/EPHEMEROPTERA	#REF!
Hydropsychinae/TRICH	#REF!

Appendix B.1. Mountain and valley/foothill ecoregions aquatic macroinvertebrate checklist with tolerance values for biotic index (BI), metals tolerance index (MTI) and functional feeding group (FFG) designations.

Taxon	BI	MTI	FFG
COLEOPTERA			
Elmidae			
Cleptelmis ornata	4	4	4
Dubiraphia sp.	6	4	4
Heterlimnius sp.	3	3	4
Microcylloepus sp.	5	3	4
Narpus concolor	2	1	3
Optioservus spp.	5	5	4
Zaitzevia parvula	4	3	4
Dytiscidae	5	7	5
Hydrophilidae	5	7	4
Haliplidae			
Haliplus sp.	5	5	3
Brychius sp.	5	5	3
DIPTERA			
Chironomidae			
Thienemannimyia gp.	5	3	5
Diamesa sp.	5	9	4
Pagastia sp.	1	9	4
Potthastia sp.	2	9	4
Brillia sp.	4	4	3
Cardiocladius sp.	5	9	5
Corynoneura sp.	7	4	4
Cricotopus sp.	7	9	4
Cricotopus nostococladius	6	5	3
Eukiefferiella spp.	8	9	4
Heterotrissocladius sp.	0	3	4
Nanocladius sp.	3	4	4
Orthocladius sp.	6	5	4
Parametriocnemus sp.	5	4	4
Paraphaenocladius sp.	4	4	4
Psectrocladius sp.	8	4	4
Pseudosmittia sp.	6	4	4
Rheocricotopus sp.	4	5	4
Synorthocladius sp.	2	1	4
Tvetenia sp.	5	4	4
Cryptochironomus sp.	8	5	4
Microtendipes sp.	6	4	4
Polypedilum sp.	6	4	4
Robackia sp.	4	4	4
Stictochironomus sp.	5	4	4

Appendix B.1. Mountain and valley/foothill ecoregions aquatic macroinvertebrate checklist with tolerance values for biotic index (BI), metals tolerance index (MTI) and functional feeding group (FFG) designations.

Taxon	BI	MTI	FFG
Micropsectra sp.	4	1	4
Tanytarsus sp.	6	3	2
Rheotanytarsus sp.	6	1	2
Tipulidae			
Antocha sp.	3	4	4
Dicranota sp.	3	2	4
Hexatoma sp.	2	2	5
Tipula sp.	4	4	3
Psychodidae			
Pericoma sp.	4	4	4
Blephariceridae			
Agathon sp.	0	0	1
Empididae	6	6	5
Ceratopogoninae	6	4	5
Stratiomyiidae	7	4	4
Tabanidae	6	3	5
Simuliidae			
Simulium spp. (Psilozoa)	7	7	2
Simulium spp. (Eusimulium)	5	5	2
EPHEMEROPTERA			
Baetidae			
Baetis tricaudatus	4	5	4
Baetis punctiventris	6	3	4
Acentrella insignificans	4	4	4
Ephemerellidae			
Drunella coloradensis	0	0	1
Drunella doddsi	1	0	1
Drunella flavilinea	2	0	4
Drunella grandis	2	1	4
Drunella spinifera	0	0	1
Ephemerella inermis	4	3	4
Serratella sp.	2	1	4
Heptageniidae			
Cinygmula sp.	0	0	1
Epeorus deceptivus	0	0	1
Epeorus longimanus	1	0	1
Heptagenia sp.	4	1	1
Rhithrogena sp.	0	2	1
Tricorythidae			
Tricorythodes sp.	4	4	4

Appendix B.1. Mountain and valley/foothill ecoregions aquatic macroinvertebrate checklist with tolerance values for biotic index (BI), metals tolerance index (MTI) and functional feeding group (FFG) designations.

Taxon	BI	MTI	FFG
Caenidae			
Caenis sp.	7	3	4
Leptophlebiidae			
Paraleptophlebia sp.	1	1	4
PLECOPTERA			
Chloroperlidae			
Chloroperlinae	1	2	5
Kathroperla sp.	1	2	5
Leuctridae	0	0	3
Nemouridae			
Amphinemura sp.	2	1	3
Podmosta sp.	2	1	3
Zapada oregenensis gp.	2	1	3
Pteronarcidae			
Pteronarcella sp.	4	4	3
Pteronarcys sp.	2	2	3
Perlidae			
Claassinia sabulosa	3	3	5
Hesperoperla pacifica	1	3	5
Doroneuria sp.	0	2	5
Perlodidae			
Isoperla sp.	2	3	5
Kogotus sp.	1	2	5
Megarcys sp.	1	1	5
Skwala sp.	3	3	5
TRICHOPTERA			
Hydropsychidae			
Hydropsyche spp.	5	5	2
Ceratopsyche spp.	5	5	2
Cheumatopsyche spp.	5	5	2
Arctopsyche sp.	2	3	2
Hydroptilidae			
Hydroptila sp.	6	4	4
Ochrotrichia sp.	4	3	4
Leptoceridae			
Ceraclea sp.			
Oecetis sp.			
Glossosomatidae			
Glossosoma sp.	0	2	1
Lepidostomatidae			
Lepidostoma sp.	1	1	3

Appendix B.1. Mountain and valley/foothill ecoregions aquatic macroinvertebrate checklist with tolerance values for biotic index (BI), metals tolerance index (MTI) and functional feeding group (FFG) designations.

Taxon	BI	MTI	FFG
Brachycentridae			
Brachycentrus americanus	1	4	1
Brachycentrus occidentalis	2	3	2
Micrasema sp.	1	2	3
Rhyacophilidae			
Rhyacophila brunnea gp.	2	1	5
Rhyacophila coloradensis gp.	0	1	5
Rhyacophila sibirica gp.	0	1	5
Helicopsychidae			
Helicopsyche b.	3	3	1
HEMIPTERA			
Corrixidae			
Sigara sp.	5	5	5
ODONATA			
Libellula sp.	9	4	5
Enalagma sp.	7	3	5
ANNELIDA			
Glossophonidae			
Hellobdella stagnalis	10	4	5
Enchytraeidae	4	1	4
Lumbricidae	4	1	4
Lumbriculidae	4	1	4
Naididae	8	5	4
Tubificidae	10	6	4
MOLLUSCA			
Lymnaeidae	6	3	1
Planorbiidae	6	3	1
Physidae	8	4	1
Sphaeriidae	8	3	2
CRUSTACEA			
Decapoda	6	3	3
Gammarus sp.	4	3	3
Hyalella azteca	8	3	4
Turbellaria	4	4	5

APPENDIX B.2

Macroinvertebrate data
valley & foothill stream
mountain streams
1994

raw data and metrics

Jerry Creek
Big Pipestone Creek
Pintlar Creek
Ruby River
Duck Creek
Elk Creek
Cottonwood Creek
Beaver Creek (Fergus Co.)

Mussigbrod Creek
Wise River
Birch Creek
Basin Creek
Crow Creek
Beaver Creek (Lewis & Clark Co.)
Dry Fork Belt Creek

AQUATIC MACROINVERTEBRATE DATA								
RBP kick samples 1994 statewide stream surveys								
valley & foothills streams								
Stream*:	Jerry	Big	Big	Pintler	Ruby	MEAN	D	%RDif
Taxon	Creek	Pipestone	Pipestone	Creek	River			
COLEOPTERA								
Heterlimnius sp.	50	0	0	0	0			
Microcylloepus sp.	0	0	0	0	1			
Optioservus spp.	0	1	1	7	40			
Zaitzevia parvula	0	2	2	0	0			
Dytiscidae	0	1	1	5	3			
Hydrophilidae	0	0	0	2	0			
Haliplus sp.	0	0	0	5	0			
Brychius sp.	0	0	0	3	0			
DIPTERA								
Thienemannimyia gp.	1	0	0	58	2			
Pagastia sp.	0	0	0	0	17			
Cricotopus sp.	0	68	77	5	0			
Cricotopus nostococladius	1	0	0	0	0			
Eukiefferiella spp.	5	6	7	0	14			
Heterotrissocladius sp.	0	0	0	3	0			
Orthocladius sp.	2	0	0	0	0			
Parametriocnemus sp.	0	0	1	4	2			
Paraphaenocladius sp.	0	0	0	1	0			
Psectrocladius sp.	0	0	0	1	0			
Tvetenia sp.	2	0	0	0	10			
Cryptochironomus sp.	0	0	0	1	1			
Microtendipes sp.	0	0	0	0	1			
Polypedilum sp.	0	0	0	0	10			
Stictochironomus sp.	0	0	0	3	0			
Micropsectra sp.	0	0	0	8	2			
Tanytarsus sp.	0	0	0	3	4			
Rheotanytarsus sp.	0	0	0	0	15			
Dicranota sp.	0	0	0	3	0			
Hexatoma sp.	0	0	0	0	2			
Tipula sp.	0	0	0	3	0			
Pericoma sp.	4	0	0	0	0			
Stratiomyiidae	0	0	0	0	1			
Simulium spp. (Psilozoa)	0	6	7	3	3			
Simulium spp. (Eusimulium)	14	0	0	0	0			

AQUATIC MACROINVERTEBRATE DATA								
RBP kick samples 1994 statewide stream surveys								
valley & foothills streams								
Stream*:	Jerry	Big	Big	Pintler	Ruby	MEAN	D	%RDif
Taxon	Creek	Pipestone	Pipestone	Creek	River			
EPHEMEROPTERA								
Baetis tricaudatus	17	5	7	0	19			
Baetis punctiventris	0	0	0	0	1			
Drunella doddsi	2	0	0	0	0			
Drunella spinifera	2	0	0	0	0			
Cinygmula sp.	3	0	0	0	0			
Epeorus longimanus	1	0	0	0	0			
Heptagenia sp.	0	0	0	0	1			
Tricorythodes sp.	0	4	4	0	41			
Paraleptophlebia sp.	0	0	0	15	3			
PLECOPTERA								
Leuctridae	2	0	0	0	0			
Amphinemura sp.	0	0	0	2	0			
Zapada oregenensis gp.	1	0	0	0	0			
Isoperla sp.	0	0	1	0	3			
Skwala sp.	0	1	1	0	8			
TRICHOPTERA								
Hydropsyche spp.	0	5	6	0	5			
Ceratopsyche spp.	0	64	70	0	38			
Cheumatopsyche spp.	0	77	91	0	1			
Hydroptila sp.	0	1	1	0	0			
Ceraclea sp.	0	0	0	1	0			
Brachycentrus americanus	0	0	0	0	1			
Brachycentrus occidentalis	0	0	0	0	10			
Rhyacophila brunnea gp.	6	0	0	0	0			
Rhyacophila sibirica gp.	4	0	0	0	0			
Helicopsyche b.	0	0	0	0	3			
HEMIPTERA								
Sigara sp.	0	0	0	16	2			
ODONATA								
Libellula sp.	0	0	0	1	0			

AQUATIC MACROINVERTEBRATE DATA								
RBP kick samples 1994 statewide stream surveys								
valley & foothills streams								
Stream*:	Jerry	Big	Big	Pintler	Ruby	MEAN	D	%RDif
Taxon	Creek	Pipestone	Pipestone	Creek	River			
ANNELIDA								
Enchytraeidae	23	0	0	0	0			
Lumbricidae	6	0	0	4	1			
Lumbriculidae	0	0	0	1	0			
Helobdella stagnalis	0	0	0	16	0			
Tubificidae	0	1	1	3	11			
MOLLUSCA								
Physidae	0	0	0	6	21			
Sphaeriidae	0	0	0	1	1			
CRUSTACEA								
Cladocera	0	92	0	0	0			
Decapoda	0	0	0	0	1			
Hyalella azteca	0	0	0	82	0			
OTHER								
Turbellaria	128	0	0	7	0			
IDs by D. McGuire								

AQUATIC MACROINVERTEBRATE DATA							
RBP kick samples 1994 statewide stream surveys							
valley & foothills streams							
Stream*:	Jerry	Big	Big	Pintler	Ruby	MEAN	D %RDif
Taxon	Creek	Pipestone	Pipestone	Creek	River		
TOTAL ORGANISMS	274	334	278	273	299	292	7%
TAXA RICHNESS	20	15	16	31	36	23.6	34%
EPT RICHNESS	9	7	8	3	13	8.0	30%
BIOTIC INDEX	3.73	6.30	5.64	6.02	5.03	5.3	14%
METALS TOLERANCE INDEX	3.45	5.35	6.22	3.53	4.65	4.6	20%
% DOMINANT TAXON	47%	28%	33%	30%	14%	30%	25%
% CHIRONOMIDAE	4%	22%	31%	32%	26%	23%	34%
% EPT	14%	47%	65%	7%	45%	35%	57%
% COLLECTORS (g+f)	45%	99%	99%	57%	84%	77%	27%
% SCRAPERS + SHREDDERS	4%	0%	0%	5%	9%	4%	80%
Hydropsychinae/TRICH	0%	99%	99%	0%	76%	55%	80%
Baetidae/EPHEMEROPTERA	68%	56%	64%	0%	31%	44%	52%
SHANNON DIVERSITY	2.70	2.56	2.41	3.63	4.21	3.10	21%
EPT/(EPT + Chironomidae)	0.78	0.68	0.68	0.17	0.63	0.59	28%
% FILTERERS	5%	73%	63%	3%	26%	34%	80%
% COLLECTOR-GATHERERS	40%	26%	36%	55%	59%	43%	25%
% SHREDDERS	1%	0%	0%	3%	0%	1%	106%
% SCRAPERS	3%	0%	0%	2%	9%	3%	88%
% PREDATORS	51%	1%	1%	38%	7%	19%	103%
Scraper/(Scraper+Filterer)	36%	0%	0%	46%	25%	22%	80%
% COLEOPTERA	18%	1%	1%	8%	15%	9%	71%
% DIPTERA	11%	24%	33%	35%	28%	26%	27%
% EPHEMEROPTERA	9%	3%	4%	5%	22%	9%	64%
% PLECOPTERA	1%	0%	1%	1%	4%	1%	73%
% TRICHOPTERA	4%	44%	60%	0%	19%	26%	83%
Jerry Creek - 1.2 mi above mouth - 9/7/94- 60sX12ft- 40% of sample sorted							
Big Pipestone Creek-near mouth - 9/9/94- 22% of sample sorted - Daphnia counted.							
Big Pipestone Creek-near mouth - 9/9/94- 33% of sample sorted - Daphnia not included.							
Pintler Creek-near mouth- 8/10/94- 60% of sample sorted.							
Ruby River (lower)- 8/15/94- 60sX15ft- 22% of sample sorted							

AQUATIC MACROINVERTEBRATE DATA							
RBP kick samples 1994 statewide stream surveys							
valley & foothills streams							
Stream:	Duck	Elk	Cottonwood	Beaver	MEAN	AV. DEV.	%RDif
Taxon	Creek	Creek	Creek	Creek			
COLEOPTERA							
Dubiraphia sp.	0	0	0	1			
Optioservus spp.	0	31	7	16			
Zaitzevia parvula	0	7	1	1			
DIPTERA							
Thienemannimyia gp.	2	1	4	0			
Potthastia sp.	0	0	1	0			
Corynoneura sp.	0	1	1	0			
Cricotopus sp.	23	0	50	36			
Eukiefferiella spp.	2	1	2	5			
Nanocladius sp.	0	0	0	7			
Orthocladius sp.	6	0	25	2			
Parametriocnemus sp.	0	9	1	0			
Pseudosmittia sp.	0	1	0	0			
Rheocricotopus sp.	0	0	4	0			
Tvetenia sp.	0	15	1	0			
Microtendipes sp.	0	11	0	2			
Polypedilum sp.	0	3	0	0			
Robackia sp.	0	0	0	1			
Micropsectra sp.	0	12	8	0			
Tanytarsus sp.	0	1	0	0			
Rheotanytarsus sp.	0	0	1	0			
Dicranota sp.	2	0	1	0			
Hexatoma sp.	0	0	5	0			
Tipula sp.	0	0	0	2			
Tabanidae	0	0	0	1			
Empididae	0	0	0	2			
Ceratopogoninae	2	0	0	0			
Limnophora sp.	1	0	0	1			
Simulium spp. (Psilozoa)	86	0	0	0			
Simulium spp. (Eusimulium)	0	0	0	1			
EPHEMEROPTERA							
Baetis tricaudatus	12	18	2	18			
Acentrella insignificans	4	1	0	0			
Heptagenia sp.	0	0	0	1			
Rhithrogena sp.	0	1	10	0			
Caenis sp.	6	0	2	0			
Tricorythodes sp.	2	0	9	19			
Paraleptophlebia sp.	0	4	22	0			

AQUATIC MACROINVERTEBRATE DATA							
RBP kick samples 1994 statewide stream surveys							
valley & foothills streams							
Stream:	Duck	Elk	Cottonwoo	Beaver	MEAN	AV. DEV.	%RDif
Taxon	Creek	Creek	Creek	Creek			
PLECOPTERA							
Chloroperlinae	0	1	19	0			
Hesperoperla pacifica	0	0	3	0			
Isoperla sp.	0	0	1	0			
Skwala sp.	0	0	16	0			
TRICHOPTERA							
Hydropsyche spp.	8	3	3	10			
Ceratopsyche spp.	4	26	61	27			
Cheumatopsyche spp.	4	4	2	12			
Hydroptila sp.	0	0	0	3			
Ochrotrichia sp.	0	2	0	0			
Oecetis sp.	0	1	0	0			
Brachycentrus occidentalis	11	114	1	14			
Helicopsyche b.	0	0	2	26			
ODONATA							
Enalagma sp.	0	0	1	0			
ANNELIDA							
Lumbricidae	0	1	0	1			
Naididae	0	0	0	2			
Tubificidae	1	1	0	23			
MOLLUSCA							
Physidae	19	1	3	48			
Gyraulus sp.	2	0	0	0			
Fossaria sp.	2	1	1	0			
CRUSTACEA							
Gammarus sp.	1	0	0	0			
Hyalella azteca	87	0	0	1			
OTHER							
Turbellaria	0	3	0	0			
IDs by D. McGuire							

AQUATIC MACROINVERTEBRATE DATA							
RBP kick samples 1994 statewide stream surveys							
valley & foothills streams							
Stream:	Duck	Elk	Cottonwoo(	Beaver	MEAN	AV. DEV.I	%RDif
Taxon	Creek	Creek	Creek	Creek			
TOTAL ORGANISMS	287	275	270	283	279	6.3	2%
TAXA RICHNESS	22	28	32	28	27.5	2.8	10%
EPT RICHNESS	8	11	14	9	10.5	2.0	19%
BIOTIC INDEX	6.81	3.63	4.40	5.76	5.2	1.1	22%
METALS TOLERANCE INDEX	5.09	3.67	4.67	5.03	4.6	0.5	10%
% DOMINANT TAXON	30%	41%	23%	17%	28%	8%	29%
% CHIRONOMIDAE	11%	20%	36%	19%	22%	7%	34%
% EPT	18%	64%	57%	46%	46%	14%	31%
% COLLECTORS (g+f)	90%	97%	76%	72%	84%	10%	12%
% SCRAPERS + SHREDDERS	8%	1%	6%	27%	11%	8%	78%
Hydropsychinae/TRICH	59%	22%	96%	53%	58%	20%	35%
Baetidae/EPHEMEROPTERA	67%	79%	4%	47%	49%	24%	48%
SHANNON DIVERSITY	3.04	3.19	3.78	3.89	3.47	0.36	10%
EPT/(EPT + Chironomidae)	0.61	0.76	0.61	0.71	0.67	0.06	9%
% FILTERERS	39%	54%	25%	23%	35%	11%	32%
% COLLECTOR-GATHERERS	51%	43%	51%	49%	48%	3%	6%
% SHREDDERS	0%	0%	0%	1%	0%	0%	100%
% SCRAPERS	8%	1%	6%	27%	10%	8%	78%
% PREDATORS	1%	2%	18%	1%	6%	6%	109%
Scraper/(Scraper+Filterer)	17%	2%	19%	54%	23%	15%	67%
% COLEOPTERA	0%	14%	3%	6%	6%	4%	74%
% DIPTERA	43%	20%	39%	21%	31%	10%	33%
% EPHEMEROPTERA	8%	9%	17%	13%	12%	3%	28%
% PLECOPTERA	0%	0%	14%	0%	4%	5%	145%
% TRICHOPTERA	9%	55%	26%	33%	31%	13%	43%
Duck Creek- 10/6/94- 60sX15ft- 90% of sample sorted.							
Elk CreeK- mouth- 9/5/94- 50% of sample sorted							
Cottonwood Creek- 9/8/94- 50% of sample sorted.							
Beaver Creek(trib to Cottonwood)- 9/8/94- 50% of sample sorted.							

AQUATIC MACROINVERTEBRATE DATA							
RBP kick samples 1994 statewide stream surveys							
valley & foothills/mountain streams							
Stream:	Mussigbrod	Wise	Birch	Basin	MEAN	AV. DEV	%RDif
Taxon	Creek	River	Creek	Creek			
COLEOPTERA							
Cleptelmis ornata	2	0	2	0			
Heterlimnius sp.	0	0	2	0			
Narpus concolor	0	0	2	0			
Optioservus spp.	18	0	12	21			
Zaitzevia parvula	3	5	0	0			
Dytiscidae	0	0	0	1			
DIPTERA							
Thienemannimyia gp.	4	10	0	0			
Pagastia sp.	23	15	10	0			
Potthastia sp.	3	1	0	2			
Corynoneura sp.	0	2	0	0			
Cricotopus spp.	65	42	5	13			
Cricotopus nostococladius	5	6	0	0			
Eukiefferiella spp.	0	29	19	11			
Orthocladius sp.	0	1	4	3			
Paraphaenocladius sp.	2	0	4	5			
Rheocricotopus sp.	3	0	0	2			
Synorthocladius sp.	0	2	0	0			
Tvetenia sp.	17	36	31	13			
Micropsectra sp.	43	23	25	0			
Rheotanytarsus sp.	0	0	0	1			
Antocha sp.	0	6	0	1			
Dicranota sp.	0	0	6	0			
Hexatoma sp.	5	0	14	0			
Tipula sp.	1	0	0	1			
Empididae	0	4	1	0			
Agathon sp.	0	0	4	0			
Simulium spp. (Eusimulium)	0	1	0	41			

AQUATIC MACROINVERTEBRATE DATA							
RBP kick samples 1994 statewide stream surveys							
valley & foothills/mountain streams							
Stream:	Mussigbrod	Wise	Birch	Basin	MEAN	AV. DEV	%RDif
Taxon	Creek	River	Creek	Creek			
EPHEMEROPTERA							
Baetis tricaudatus	5	11	16	23			
Baetis punctiventris	1	0	0	0			
Acentrella insignificans	0	0	0	1			
Drunella coloradensis	0	0	12	0			
Drunella doddsi	0	0	7	0			
Drunella grandis	0	3	2	0			
Serratella sp.	0	0	29	3			
Cinygmula sp.	0	0	31	0			
Epeorus deceptivus	0	0	5	0			
Epeorus longimanus	0	0	3	6			
Rhithrogena sp.	0	0	2	5			
Paraleptophlebia sp.	9	2	0	0			
PLECOPTERA							
Chloroperlinae	11	0	2	1			
Amphinemura sp.	10	0	12	25			
Pteronarcys sp.	0	1	0	0			
Claassinia sabulosa	0	1	0	1			
Hesperoperla pacifica	1	0	0	0			
Doroneuria sp.	0	0	0	2			
Isoperla sp.	2	0	0	0			
Megarcys sp.	0	0	1	3			
Skwala sp.	0	0	0	6			
TRICHOPTERA							
Ceratopsyche spp.	36	18	0	14			
Arctopsyche sp.	0	1	22	7			
Hydroptila sp.	0	0	0	1			
Glossosoma sp.	0	0	8	0			
Lepidostoma sp.	0	41	1	1			
Brachycentrus americanus	13	35	0	1			
Brachycentrus occidentalis	0	1	0	0			
Micrasema sp.	1	3	0	1			
Rhyacophila brunnea gp.	3	0	8	0			
Rhyacophila coloradensis gp	0	0	0	1			
ANNELIDA							
Enchytraeidae	0	0	3	0			
Lumbricidae	5	0	0	0			
Tubificidae	0	1	0	0			

AQUATIC MACROINVERTEBRATE DATA							
RBP kick samples 1994 statewide stream surveys							
valley & foothills/mountain streams							
Stream:	Mussigbrod	Wise	Birch	Basin	MEAN	AV. DEV	%RDif
Taxon	Creek	River	Creek	Creek			
MOLLUSCA							
Sphaeriidae	19	0	0	0			
IDs by D. McGuire							
TOTAL ORGANISMS	310	301	305	217	283	33.1	12%
TAXA RICHNESS	27	27	32	31	29.3	2.3	8%
EPT RICHNESS	11	11	16	18	14.0	3.0	21%
BIOTIC INDEX	4.52	4.14	2.85	4.14	3.9	0.5	14%
METALS TOLERANCE INDEX	4.81	4.81	2.78	4.36	4.2	0.7	17%
% DOMINANT TAXON	21%	14%	10%	19%	16%	4%	25%
% CHIRONOMIDAE	53%	55%	32%	23%	41%	13%	33%
% EPT	30%	39%	53%	47%	42%	8%	19%
% COLLECTORS (g+f)	82%	66%	67%	75%	72%	6%	8%
% SCRAPERS + SHREDDERS	10%	29%	25%	18%	20%	6%	31%
Hydropsychinae/TRICH	68%	18%	0%	54%	35%	26%	74%
Baetidae/EPHEMEROPTERA	40%	69%	15%	63%	47%	19%	41%
SHANNON DIVERSITY	3.86	3.82	4.40	4.01	4.03	0.19	5%
EPT/(EPT + Chironomidae)	0.36	0.41	0.62	0.67	0.52	0.13	25%
% FILTERERS	18%	7%	7%	29%	15%	8%	53%
% COLLECTOR-GATHERERS	64%	59%	60%	46%	57%	6%	10%
% SHREDDERS	5%	17%	5%	13%	10%	5%	48%
% SCRAPERS	4%	12%	20%	6%	10%	5%	53%
% PREDATORS	8%	5%	9%	7%	7%	1%	17%
Scraper/(Scraper+Filterer)	19%	63%	73%	16%	43%	25%	59%
% COLEOPTERA	7%	2%	6%	10%	6%	2%	40%
% DIPTERA	55%	59%	40%	43%	49%	8%	16%
% EPHEMEROPTERA	5%	5%	35%	18%	16%	11%	68%
% PLECOPTERA	8%	1%	5%	18%	8%	5%	64%
% TRICHOPTERA	17%	33%	13%	12%	19%	7%	38%
Mussigbrod Creek- nr mouth- 8/10/94- 25% of sample sorted							
Wise River - above bridge in Wise River- 9/9/94- 60sec/15ft- 22% of sampe sorted.							
Birch Creek- 8/15/94- 60sX15ft- 25% of sample sorted							
Basin Creek- 8/16/94- 75 sX11ft- entire sample used (poorly preserved, bugs mangled)							

AQUATIC MACROINVERTEBRATE DATA								
RBP kick samples 1994 statewide stream surveys								
mountain streams								
Stream*:	Crow	Beaver	Dry Fork	Birch	Basin	MEAN	AV. DEV	%RDif
Taxon	Creek	Creek	Belt Cr.	Creek	Creek			
COLEOPTERA								
Cleptelmis ornata	0	1	0	2	0			
Heterlimnius sp.	0	0	0	2	0			
Narpus concolor	0	0	0	2	0			
Optioservus spp.	0	9	0	12	21			
Dytiscidae	0	0	0	0	1			
Brychius sp.	0	2	0	0	0			
DIPTERA								
Diamesa sp.	0	0	1	0	0			
Pagastia sp.	0	3	0	10	0			
Potthastia sp.	0	0	0	0	2			
Brillia sp.	0	0	1	0	0			
Cardiocladius sp.	0	1	0	0	0			
Corynoneura sp.	0	1	0	0	0			
Cricotopus sp.	0	18	0	5	13			
Eukiefferiella spp.	2	8	0	19	11			
Orthocladius sp.	0	36	3	4	3			
Parametriocnemus sp.	2	0	0	0	0			
Paraphaenocladius sp.	0	0	0	4	5			
Rheocricotopus sp.	0	0	0	0	2			
Tvetenia sp.	5	0	1	31	13			
Polypedilum sp.	3	0	0	0	0			
Micropsectra sp.	6	0	0	25	0			
Rheotanytarsus sp.	0	8	0	0	1			
Antocha sp.	0	3	0	0	1			
Dicranota sp.	0	0	1	6	0			
Hexatoma sp.	0	0	0	14	0			
Tipula sp.	0	0	0	0	1			
Agathon sp.	0	0	0	4	0			
Empididae	7	20	0	1	0			
Simulium spp. (Eusimulium)	99	4	0	0	41			

AQUATIC MACROINVERTEBRATE DATA								
RBP kick samples 1994 statewide stream surveys								
mountain streams								
Stream*:	Crow	Beaver	Dry Fork	Birch	Basin	MEAN	AV. DEV	%RDif
Taxon	Creek	Creek	Belt Cr.	Creek	Creek			
EPHEMEROPTERA								
Baetis tricaudatus	3	90	0	16	23			
Acentrella insignificans	0	0	0	0	1			
Drunella coloradensis	0	0	0	12	0			
Drunella flavilinea	6	19	0	0	0			
Drunella doddsi	0	0	0	7	0			
Drunella grandis	0	0	0	2	0			
Ephemerella inermis	0	12	0	0	0			
Serratella sp.	0	0	0	29	3			
Cinygmula sp.	115	3	0	31	0			
Epeorus deceptivus	0	0	0	5	0			
Epeorus longimanus	28	0	0	3	6			
Rhithrogena sp.	0	1	0	2	5			
PLECOPTERA								
Chloroperlinae	0	0	0	2	1			
Kathroperla sp.	0	0	12	0	0			
Amphinemura sp.	0	0	0	12	25			
Podmosta sp.	0	0	12	0	0			
Pteronarcys sp.	0	2	0	0	0			
Claassinia sabulosa	0	0	0	0	1			
Hesperoperla pacifica	0	3	1	0	0			
Doroneuria sp.	0	0	0	0	2			
Isoperla sp.	1	1	0	0	0			
Kogotus sp.	0	0	1	0	0			
Megarcys sp.	0	0	0	1	3			
Skwala sp.	0	0	0	0	6			
TRICHOPTERA								
Ceratopsyche spp.	0	15	0	0	14			
Arctopsyche sp.	0	0	0	22	7			
Hydroptila sp.	0	0	0	0	1			
Glossosoma sp.	0	3	0	8	0			
Lepidostoma sp.	0	0	1	1	1			
Brachycentrus americanus	2	8	2	0	1			
Micrasema sp.	0	0	0	0	1			
Rhyacophila angelita gp.	0	0	13	0	0			
Rhyacophila brunnea gp.	0	15	0	8	0			
Rhyacophila coloradensis gp	0	0	0	0	1			
Rhyacophila sibirica gp.	1	0	0	0	0			

AQUATIC MACROINVERTEBRATE DATA								
RBP kick samples 1994 statewide stream surveys								
mountain streams								
Stream*:	Crow	Beaver	Dry Fork	Birch	Basin	MEAN	AV. DEV	%RDif
Taxon	Creek	Creek	Belt Cr.	Creek	Creek			
ANNELIDA								
Enchytraeidae	0	0	0	3	0			
Lumbricidae	2	0	0	0	0			
Lumbriculidae	0	11	0	0	0			
IDs by D. McGuire								
TOTAL ORGANISMS	282	297	49	305	217	230	77.6	34%
TAXA RICHNESS	15	26	12	32	31	23.2	7.8	33%
EPT RICHNESS	7	12	7	16	18	12.0	4.0	33%
BIOTIC INDEX	2.46	4.35	1.55	2.85	4.14	3.1	0.9	31%
METALS TOLERANCE INDEX	2.18	4.30	2.02	2.78	4.36	3.1	1.0	31%
% DOMINANT TAXON	41%	30%	27%	10%	19%	25%	9%	34%
% CHIRONOMIDAE	6%	25%	12%	32%	23%	20%	8%	42%
% EPT	55%	58%	86%	53%	47%	60%	10%	17%
% COLLECTORS (g+f)	45%	80%	12%	63%	75%	55%	21%	38%
% SCRAPERS + SHREDDERS	51%	6%	33%	29%	18%	27%	12%	44%
Hydropsychinae/TRICH	0%	37%	0%	0%	54%	18%	22%	120%
Baetidae/EPHEMEROPTERA	2%	72%		15%	63%	38%	30%	78%
SHANNON DIVERSITY	2.26	3.68	2.74	4.40	4.01	3.42	0.73	21%
EPT/(EPT + Chironomidae)	0.90	0.70	0.88	0.62	0.67	0.75	0.11	14%
% FILTERERS	35%	9%	0%	7%	29%	16%	13%	79%
% COLLECTOR-GATHERERS	10%	71%	12%	56%	46%	39%	22%	57%
% SHREDDERS	0%	1%	29%	5%	13%	10%	9%	94%
% SCRAPERS	51%	5%	4%	24%	6%	18%	16%	87%
% PREDATORS	3%	13%	55%	9%	7%	17%	15%	86%
Scraper/(Scraper+Filterer)	59%	36%	100%	77%	16%	58%	25%	44%
% COLEOPTERA	0%	4%	0%	6%	10%	4%	3%	80%
% DIPTERA	44%	34%	14%	40%	43%	35%	9%	25%
% EPHEMEROPTERA	54%	42%	0%	35%	18%	30%	17%	56%
% PLECOPTERA	0%	2%	53%	5%	18%	16%	16%	101%
% TRICHOPTERA	1%	14%	33%	13%	12%	14%	7%	50%
* Crow Creek- 6/3//93 - 60sX9ft 25% of sample sorted								
Beaver Creek- 6/2/94- 30sX8ft - 67% of sample sorted								
Dry Fork Belt Cr.- 6/8/94 - 60sX10ft- entire sample sorted								
Birch Creek- 8/15/94- 60sX15ft- 25% of sample sorted								
Basin Creek- 8/16/94- 75 sX11ft- entire sample used (poorly preserved, bugs mangled)								